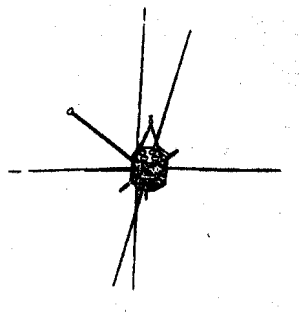
DE 2

Dynamics Explorer 2

Spacecraft Sketch	Mission Objective
	The Dynamics Explorer (DE 1&2) mission is designed to supply specific knowledge concerning the coupling of energy, electric currents and fields, and plasmas between the magnetosphere, the ionosphere and the atmosphere. The DE 1&2 spacecraft are launched into coplanar polar orbits (e.g., same plane, but different altitudes). This orbital configuration provides for data acquisition at two altitudes within common magnetic flux tubes, thus fulfilling the requirement for simultaneous data sets in the magnetosphere and in the ionosphere/atmosphere. While each DE spacecraft contributes to science through its individual complement of experiments, the mission success is primarily dependent on the combined, correlative measurements of the two sets of spacecraft experiments. A central project-funded data processing and analysis system provides users with geophysically meaningful data from all instruments.

TYPE OF MISSION	PROGRAM OFFICE	PROJECT LEAD CENTER	MANAGEMENT APPROACH	S/C CONTRACTOR	I&T CONTRACTOR
SPACE PHYSICS	SPACE SCIENCE	GSFC	HYBRID	RCA	RCA

Payload Description

Dynamics Explorer (DE 2) low-altitude mission payload consists of two field, one optical emissions, two neutral particle and four charged particle instruments. The DE 2 is one of two spacecraft that is launched by the same vehicle into a polar coplanar orbit, thus permitting simultaneous measurements at high and low altitudes in the same field-line region. The IDE 2 spacecraft approximates a short polygon on which are mounted the triaxial antennas, and the solar cell array which charges the two 6-nickel cadmium batteries. The spacecraft is three-axis stabilized with the yaw axis aligned toward the center of the earth and with the spin axis normal to the orbit plane. A single-axis scan platform which rotates about the spin axis is included in order to mount one of the instruments. A pulse code modulation (PCM) telemetry data system operates in either real time or a tape recorder mode. The data is acquired from the instruments and temporarily stored on tape recorders for later transmission. Commands are stored in a command memory unit. This allows non-real-time spacecraft operation except for the transmission of analog data from one instrument.

INSTRUMENT NAME	ACRONYM	PI AFFILIATION	PRINCIPAL INVESTIGATOR	I&T CONTRACTOR
FABRY-PEROT INTERFEROMETER	FPI	UNIV MICHIGAN	P. B. HAYS	UNIV MICHIGAN
ION DRIFT METER	IDM	UNIV TEXAS-DALLAS	R. A. HEELIS	UNIV TEXAS-DALLAS
LANGMUIR PROBE	LANG	GSFC	L. H. BRACE	GSFC
LOW ALTITUDE PLASMA INSTRUMENT	LAPI	UNIV TEXAS-DALLAS	J. D. WINNINGHAM	UNIV TEXAS-DALLAS
MAGNETOMETER	MAG-B	GSFC	M. SUGIURA	GSFC
NEUTRAL ATMOSPHERE COMPOSITION SPECTROMETER	NACS	UNIV MICHIGAN	C. R. CARIGNAN	UNIV MICHIGAN
RETARDING POTENTIAL ANALYZER	RPA	UNIV TEXAS-DALLAS	W. B. HANSON	UNIV TEXAS-DALLAS
VECTOR ELECTRIC FIELD INSTRUMENT	VEFI	GSFC	M. C. MAYNARD	GSFC
WIND & TEMPERATURE SPECTROMETER	WATS	GSFC	N. W. SPENCER	UNIV MICHIGAN

Instrument Descriptions
The DE 2 Fabry-Perot Interferometer (FPI), Data Point 533, is designed by the University of Michigan to measure the drift and temperature of neutral and ionic atomic oxygen using the doppler technique. This instrument is based on the Visible Airglow Experiment used in the AE program; the major differences being the addition of a scanning mirror, a Fabry-Perot Etalon, an image plane detector and a calibration lamp. The instrument uses a Flat-Plate Fabry-Perot Interferometer as the basic sensor with a single photon-counting image detector to acquire simultaneous spectral information.
The DE 2 ion Drift Meter (IDM) measures the bulk motions of the ionospheric plasma perpendicular to the satellite velocity vector and parallel to the-sensor face by using a gridded collimator and multiple collectors to determine the direction of arrival of the plasma. The drift meter has two logarithmic amplifiers and one linear difference amplifier. The logarithmic amplifiers are connected to pairs of the collector segments and provide the inputs to the difference amplifier. The output from the difference amplifier is proportional to the ratio of the currents to the pairs of collector segments. In addition to measuring the angle of arrival of the plasma at the sensor face, it is possible to monitor the total ion concentration since the sum of the currents to the two logarithmic amplifiers is very nearly proportional to this quantity.
The DE 2 Langmuir Probe (LANG) instrument is a cylindrical electrostatic probe that employs two independently operated cylindrical collectors, each mounted at the end of a short boom about one-meter long. Each collector is 5 cm long and 0.3 cm in diameter. The instrument has selectable modes of operation which provide various degrees of spatial resolution in the measurements. Maximum resolution in Ne or M is provided by fixing the potential of one probe and continuously sampling the resulting electron or ion current. The resolution is limited only by the sampling rate assigned to the instrument.
The DE 2 Low Altitude Plasma Instrument (LAN), Data Point 536, is designed and built by SWRI to provide many of the same measurements as the DE 1 High Altitude Plasma Instrument. The instrument uses an array of 15 electrostatic analyzers, each with an electron channel and most with an ion channel, to provide measurements in the 5 eV to 25 KeV energy range. Technological inheritance includes the detectors and low voltage power supply from ISIS 2, the pre-amplifier from Pioneer-10, the programmed power supply from ISEE and the high voltage power supply from AE.
The DE 1 Magnetometer (MAG-B) instrument is a three-axis fluxgate magnetometer. Track and hold modules are used to obtain simultaneous samples on all three-axes. A precision filter external to the fluxgate loop is provided to define the instrument bandwidth and transient response. The instrumental bandwidth is 25 Hz in order to adequately describe spatial structure in field patterns and to minimize dynamic error on the low-altitude spacecraft. The accuracy of the measurement depends on instrumental error sources, thermal control of the sensor, boom stability, and deployment accuracy.
The DE 2 Neutral Atmosphere Composition Spectrometer (MACS), Data Point 538, is designed and built by the University of Michigan. The objectives of the experiment are to obtain measurements of the neutral atmospheric composition and to study variations of the neutral atmosphere in response to the magnetosphere. The instrument is a quadrapole mass spectrometer closely related to those flown on the AE 3,4&5 spacecraft. The detection system consists of an off-axis beryllium-copper dynode multiplier to provide an output pulse of electrons for each ion arrival.
The DE 2 Retarding Potential Analyzer (RPA) is a multigridded planar retarding potential analyzer very similar in concept and geometry to the instruments carried on the AE satellites. A pair of aperture grids are held at spacecraft ground and a second pair of grids comprise the retarding sweep grid. The potential on these grids determines the energy of the ions that can reach the electrometer collector. The retarding potential will be varied in different sequences to provide information on the ion thermal energy distribution. The electrically negative suppressor grid between the sweep grid and the collector serves to suppress solar UV ejected photoelectrons and also to shield the collector from ambient electrons.
The DE 2 Vector Electric Field Instrument (VEFI) consists of six, 11-meter-long, 28-mm-diameter cylindircal elements for each of the six antennas necessary for the 3-axis measurement. The antennas are insulated from the plasma over all but the outer two meters. The baseline, or distance between the midpoints of these two meter active elements, is 20 meters. The antennas will be interlocked along the edges to prevent oscillation due to thermal pumping and to increase their rigidity against forces from drag.
The DE 2 Wind and Temperature Spectrometer (WATS), Data Point 628, is designed and built by the University of Michigan to measure the concentration, kinetic energy and neutral particle motions. Concentration and velocity of ambient thermal ions is also measured. The instrument uses a quadrapole mass spectrometer as the basic sensor. Measurements are made through interpretation of the modulation of the particle stream entering the mass spectrometer.

Launch
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